

**CLAIMS**

1. A method of transmitting a base stream of data and an enhancement stream of data in a wireless communication system, comprising:  
coding and modulating the base stream to obtain a first data symbol stream, wherein the base stream is designated to be received by a plurality of receiving entities;  
coding and modulating the enhancement stream to obtain a second data symbol stream, wherein the enhancement stream is designated to be received by at least one receiving entity, and wherein the coding and modulating for the base and enhancement streams are not dependent on channel realizations of receiving entities for the base and enhancement streams;  
processing the first data symbol stream in accordance with a first spatial processing scheme to obtain a first plurality of symbol substreams;  
processing the second data symbol stream in accordance with a second spatial processing scheme to obtain a second plurality of symbol substreams, wherein the processing for the first and second data symbol streams is not dependent on the channel realizations of the receiving entities for the base and enhancement streams; and  
combining the first plurality of symbol substreams with the second plurality of symbol substreams to obtain a plurality of transmit symbol streams for transmission from a plurality of transmit antennas.
2. The method of claim 1, wherein the base stream and the enhancement stream are transmitted for a broadcast service.
3. The method of claim 2, wherein the base stream is coded, modulated, and spatially processed for recovery by receiving entities achieving a first signal-to-noise ratio (SNR) or better, and wherein the enhancement stream is coded, modulated, and spatially processed for recovery by receiving entities achieving a second SNR or better, where the second SNR is higher than the first SNR.

4. The method of claim 1, wherein the first spatial processing scheme is a transmit diversity scheme or a spatial multiplexing scheme, and wherein the second spatial processing scheme is the transmit diversity scheme or the spatial multiplexing scheme.
5. The method of claim 1, wherein each of the first and second spatial processing schemes is a transmit diversity scheme.
6. The method of claim 1, wherein each of the first and second spatial processing schemes is a space-time transmit diversity (STTD) scheme.
7. The method of claim 1, wherein the first spatial processing scheme is a transmit diversity scheme and the second spatial processing scheme is a spatial multiplexing scheme.
8. The method of claim 1, wherein each of the first and second spatial processing schemes is a spatial multiplexing scheme.
9. The method of claim 1, wherein the combining includes time division multiplexing the first plurality of symbol substreams with the second plurality of symbol substreams to obtain the plurality of transmit symbol streams.
10. The method of claim 1, wherein the combining includes scaling the first plurality of symbol substreams with a first scaling factor to obtain a first plurality of scaled symbol substreams, scaling the second plurality of symbol substreams with a second scaling factor to obtain a second plurality of scaled symbol substreams, and summing the first plurality of scaled symbol substreams with the second plurality of scaled symbol substreams to obtain the plurality of transmit symbol streams.

11. The method of claim 1, wherein the wireless communication system is a single-carrier communication system.
12. The method of claim 1, wherein the wireless communication system is a multi-carrier communication system.
13. The method of claim 1, wherein the wireless communication system implements orthogonal frequency division multiplexing (OFDM).
14. A method of transmitting a base stream of data and an enhancement stream of data in a wireless communication system, comprising:
  - coding and modulating the base stream to obtain a first data symbol stream, wherein the base stream is designated to be received by a plurality of receiving entities;
  - coding and modulating the enhancement stream to obtain a second data symbol stream, wherein the enhancement stream is designated to be received by at least one receiving entity;
  - processing the first data symbol stream in accordance with a transmit diversity scheme or a spatial multiplexing scheme to obtain a first plurality of symbol substreams;
  - processing the second data symbol stream in accordance with the transmit diversity scheme or the spatial multiplexing scheme to obtain a second plurality of symbol substreams; and
  - combining the first plurality of symbol substreams with the second plurality of symbol substreams to obtain a plurality of transmit symbol streams for transmission from a plurality of transmit antennas.
15. The method of claim 14, wherein the coding and modulating for the base and enhancement streams are not dependent on channel realizations of receiving entities for the base and enhancement streams.
16. The method of claim 14, wherein the coding and modulating for the base and enhancement streams are performed in accordance with rates selected based on channel realizations of receiving entities for the base and enhancement streams.

17. An apparatus in a wireless communication system, comprising:  
means for coding and modulating a base stream of data to obtain a first data symbol stream;  
means for coding and modulating an enhancement stream of data to obtain a second data symbol stream;  
means for processing the first data symbol stream in accordance with a first spatial processing scheme to obtain a first plurality of symbol substreams;  
means for processing the second data symbol stream in accordance with a second spatial processing scheme to obtain a second plurality of symbol substreams; and  
means for combining the first plurality of symbol substreams with the second plurality of symbol substreams to obtain a plurality of transmit symbol streams for transmission from a plurality of transmit antennas.

18. An apparatus in a wireless communication system, comprising:  
a first data processor operative to code and modulate a base stream of data to obtain a first data symbol stream;  
a second data processor operative to code and modulate an enhancement stream of data to obtain a second data symbol stream;  
a first spatial processor operative to process the first data symbol stream in accordance with a first spatial processing scheme to obtain a first plurality of symbol substreams;  
a second spatial processor operative to process the second data symbol stream in accordance with a second spatial processing scheme to obtain a second plurality of symbol substreams; and  
a combiner operative to combine the first plurality of symbol substreams with the second plurality of symbol substreams to obtain a plurality of transmit symbol streams for transmission from a plurality of transmit antennas.

19. The apparatus of claim 18, wherein the first spatial processor is operative to perform spatial processing for a transmit diversity scheme, and wherein the second spatial processor is operative to perform spatial processing for the transmit diversity scheme or a spatial multiplexing scheme.

20. The apparatus of claim 18, wherein the combiner is operative to time division multiplex the first plurality of symbol substreams with the second plurality of symbol substreams to obtain the plurality of transmit symbol streams.

21. The apparatus of claim 18, wherein the combiner is operative to scale the first plurality of symbol substreams with a first scaling factor, scale the second plurality of symbol substreams with a second scaling factor, and sum first plurality of scaled symbol substreams with second plurality of scaled symbol substreams to obtain the plurality of transmit symbol streams.

22. A method of transmitting at least two data streams in a wireless communication system, comprising:

coding and modulating each of the at least two data streams to obtain a corresponding one of at least two data symbol streams;

spatially processing each of the at least two data symbol streams in accordance with a selected spatial processing scheme to obtain a set of symbol substreams for the data symbol stream, wherein at least two sets of symbol substreams are obtained for the at least two data symbol streams; and

combining the at least two sets of symbol substreams for the at least two data symbol streams to obtain a plurality of transmit symbol streams for transmission from a plurality of transmit antennas, and wherein each of the at least two data streams is coded, modulated, and spatially processed for recovery by receiving entities achieving a different target signal-to-noise ratio (SNR) or better.

23. A method of transmitting a base stream of data and an enhancement stream of data for a broadcast service in a wireless communication system, comprising:

coding and modulating the base stream to obtain a first data symbol stream;

coding and modulating the enhancement stream to obtain a second data symbol stream;

processing the first data symbol stream in accordance with a first spatial processing scheme to obtain a first plurality of symbol substreams;

processing the second data symbol stream in accordance with a second spatial processing scheme to obtain a second plurality of symbol substreams; and

scaling the first plurality of symbol substreams with a first scaling factor to obtain a first plurality of scaled symbol substreams;  
scaling the second plurality of symbol substreams with a second scaling factor to obtain a second plurality of scaled symbol substreams; and  
summing the first plurality of scaled symbol substreams with the second plurality of scaled symbol substreams to obtain a plurality of transmit symbol streams for transmission from a plurality of transmit antennas.

24. The method of claim 23, wherein the base stream is coded, modulated, and spatially processed for recovery by receiving entities achieving a first signal-to-noise ratio (SNR) or better, and wherein the enhancement stream is coded, modulated, and spatially processed for recovery by receiving entities achieving a second SNR or better, where the second SNR is higher than the first SNR.

25. The method of claim 23, wherein the base stream and the enhancement stream are transmitted for a broadcast service.

26. The method of claim 23, wherein the base stream is designated to be received by a plurality of receiving entities and the enhancement stream is designated to be received by at least one receiving entity among the plurality of receiving entities.

27. The method of claim 23, wherein the base stream is designated to be received by a first receiving entity and the enhancement stream is designated to be received by a second receiving entity.

28. The method of claim 23, wherein the processing the first data symbol stream includes  
spatially processing the first data symbol stream in accordance with a space time transmit diversity (STTD) scheme to obtain the first plurality of symbol substreams.

29. The method of claim 28, wherein the processing the second data symbol stream includes

spatially processing the second data symbol stream in accordance with the STTD scheme to obtain the second plurality of symbol substreams.

30. The method of claim 23, wherein the processing the second data symbol stream includes

spatially processing the second data symbol stream in accordance with a spatial multiplexing scheme to obtain the second plurality of symbol substreams.

31. A method of receiving a base stream of data and an enhancement stream of data in a wireless communication system, comprising:

processing a plurality of received symbol streams, obtained via a plurality of receive antennas, in accordance with a first spatial processing scheme to provide a first recovered data symbol stream;

demodulating and decoding the first recovered data symbol stream to obtain a decoded base stream;

estimating interference due to the decoded base stream;

canceling the estimated interference due to the decoded base stream from the plurality of received symbol streams to obtain a plurality of modified symbol streams;

processing the plurality of modified symbol streams in accordance with a second spatial processing scheme to obtain a second recovered data symbol stream; and

demodulating and decoding the second recovered data symbol stream to obtain a decoded enhancement stream.

32. The method of claim 31, wherein the base stream and the enhancement stream are received for a broadcast service, wherein the base stream is coded, modulated, and spatially processed at a transmitting entity for recovery by receiving entities achieving a first signal-to-noise ratio (SNR) or better, and wherein the enhancement stream is coded, modulated, and spatially processed at the transmitting entity for recovery by receiving entities achieving a second SNR or better, where the second SNR is higher than the first SNR.

33. The method of claim 31, wherein the first spatial processing scheme is a transmit diversity scheme, and wherein the second spatial processing scheme is the transmit diversity scheme or a spatial multiplexing scheme.

34. The method of claim 31, further comprising:  
repeating the processing the plurality of received symbol streams and the demodulating and decoding the first recovered data symbol stream for a plurality of iterations to obtain the decoded base stream.

35. An apparatus in a wireless communication system, comprising:  
means for processing a plurality of received symbol streams, obtained via a plurality of receive antennas, in accordance with a first spatial processing scheme to provide a first recovered data symbol stream for a base stream of data;  
means for demodulating and decoding the first recovered data symbol stream to obtain a decoded base stream;  
means for estimating interference due to the decoded base stream;  
means for canceling the estimated interference due to the decoded base stream from the plurality of received symbol streams to obtain a plurality of modified symbol streams;  
means for processing the plurality of modified symbol streams in accordance with a second spatial processing scheme to obtain a second recovered data symbol stream for an enhancement stream of data; and  
means for demodulating and decoding the second recovered data symbol stream to obtain a decoded enhancement stream.

36. The apparatus of claim 35, further comprising:  
means for repeating the processing the plurality of received symbol streams and the demodulating and decoding the first recovered data symbol stream for a plurality of iterations to obtain the decoded base stream.

37. An apparatus in a wireless communication system, comprising:  
a first spatial processor operative to process a plurality of received symbol streams, obtained via a plurality of receive antennas, in accordance with a first spatial processing scheme to provide a first recovered data symbol stream for a base stream of data;  
a first data processor operative to demodulate and decode the first recovered data symbol stream to obtain a decoded base stream;  
an interference canceller operative to estimate interference due to the decoded base stream and cancel the estimated interference due to the decoded base stream from the plurality of received symbol streams to obtain a plurality of modified symbol streams;  
a second spatial processor operative to process the plurality of modified symbol streams in accordance with a second spatial processing scheme to obtain a second recovered data symbol stream for an enhancement stream of data; and  
a second data processor operative to demodulate and decode the second recovered data symbol stream to obtain a decoded enhancement stream.

38. A method of receiving a base stream of data and an enhancement stream of data in a wireless communication system, comprising:  
time division demultiplexing a plurality of received symbol streams, obtained via a plurality of receive antennas, to provide a first plurality of received symbol substreams for the base stream and a second plurality of received symbol substreams for the enhancement stream, wherein the base stream is designated to be received by a plurality of receiving entities and the enhancement stream is designated to be received by at least one receiving entity among the plurality of receiving entities;  
processing the first plurality of received symbol substreams in accordance with a first spatial processing scheme to obtain a first recovered data symbol stream;  
processing the second plurality of received symbol substreams in accordance with a second spatial processing scheme to obtain a second recovered data symbol stream;

demodulating and decoding the first recovered data symbol stream to obtain a decoded base stream; and

demodulating and decoding the second recovered data symbol stream to obtain a decoded enhancement stream.

39. The method of claim 38, wherein the base stream and the enhancement stream are received for a broadcast service, wherein the base stream is coded, modulated, and spatially processed at a transmitting entity for recovery by receiving entities achieving a first signal-to-noise ratio (SNR) or better, and wherein the enhancement stream is coded, modulated, and spatially processed at the transmitting entity for recovery by receiving entities achieving a second SNR or better, where the second SNR is higher than the first SNR.

40. The method of claim 38, wherein the first spatial processing scheme is a transmit diversity scheme, and wherein the second spatial processing scheme is the transmit diversity scheme or a spatial multiplexing scheme.

41. An apparatus in a wireless communication system, comprising:  
means for time division demultiplexing a plurality of received symbol streams, obtained via a plurality of receive antennas, to provide a first plurality of received symbol substreams for a base stream of data and a second plurality of received symbol substreams for an enhancement stream of data;  
means for processing the first plurality of received symbol substreams in accordance with a first spatial processing scheme to obtain a first recovered data symbol stream;  
means for processing the second plurality of received symbol substreams in accordance with a second spatial processing scheme to obtain a second recovered data symbol stream;  
means for demodulating and decoding the first recovered data symbol stream to obtain a decoded base stream; and  
means for demodulating and decoding the second recovered data symbol stream to obtain a decoded enhancement stream.

42. An apparatus in a wireless communication system, comprising:

at least one demultiplexer operative to time division demultiplex a plurality of received symbol streams, obtained via a plurality of receive antennas, to provide a first plurality of received symbol substreams for a base stream of data and a second plurality of received symbol substreams for an enhancement stream of data;

a first spatial processor operative to process the first plurality of received symbol substreams in accordance with a first spatial processing scheme to obtain a first recovered data symbol stream;

a second spatial processor operative to process the second plurality of received symbol substreams in accordance with a second spatial processing scheme to obtain a second recovered data symbol stream;

a first data processor operative to demodulate and decode the first recovered data symbol stream to obtain a decoded base stream; and

a second data processor operative to demodulate and decode the second recovered data symbol stream to obtain a decoded enhancement stream.